BRIDGE NO. 1132
Route 80, Spanning Hammonasset River
Madison
New Haven County
Connecticut

HAER NO. CT-162

HAER
CONN
5-MAD,
1-

Photographs
Written Historical and Descriptive Data

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
Philadelphia Support Office
U.S. Custom House
200 Chestnut Street
Philadelphia, PA 19106

HAER
CONN
5-MAD,
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HISTORIC AMERICAN ENGINEERING RECORD
BRIDGE NO. 1132 HAER No. CT-162

Location: Route 80, spanning Hammonasset River
Madison, New Haven County

Connecticut

USGS Clinton Quadrangle
UTM Coordinates: 18.699680.4580940

Date of Construction: 1934

Engineer: Connecticut State Highway Department

Contractor: Osborn-Barnes Construction Company

Present Owner: State of Connecticut
Department of Transportation
2800 Berlin Turnpike
Newington, Connecticut 06131-7546

Present Use: Vehicular bridge

Significance: Bridge No. 1132 is significant as an example of an open-spandrel concrete arch, a bridge design developed in the early 20th century that was well-suited for crossings that were unusually long or high, as in the case of the deep ravine through which the Hammonasset River runs at this point. The bridge is also important because it recalls the extensive program of construction undertaken by the Connecticut State Highway Department in the 1920s and 1930s.

Project Information: This documentation was undertaken in accordance with a Memorandum of Agreement between the Federal Highway Administration and the Connecticut State Historic Preservation Office. The bridge is scheduled for major rehabilitation.

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Description

Bridge No. 1132 carries state-highway Route 80 over the Hammonasset River between Madison and Killingworth, Connecticut. The river at this point runs in a deep ravine some 45 feet below the roadway, which rises in the eastward direction at about a 4-degree grade. The bridge is 231 feet long overall and consists of an open-spandrel reinforced-concrete arch center span, 100 feet in length, and six concrete-trestle approach spans 15 feet in length. The bridge's setting is densely wooded. North of the bridge is a dam impounding a water-supply reservoir known as Lake Hammonasset. A hiking trail crosses the river on a modern pedestrian bridge just north of Bridge No. 1132.

The main span takes the form of a parabolic arch segment, rising 26 feet at the crown. The two arch ribs are 5 feet wide and vary in depth from 3 feet at the springing points to 2 feet at the crown. Four struts, 18 inches square in section, provide transverse bracing for the ribs, the center lines of which are 20 feet apart. A series of columns, spaced at 10-foot intervals, rises from the top of the ribs to support transverse beams below the concrete-slab roadway. The columns, 18 inches by 36 inches in section, have simple capitals about 7 feet below the level of the roadway, above which fascia beams form round-arched openings, creating an arcade effect. The end columns, above the arch footings, are larger in dimension and are decorated with a single recessed panel on the outside face. All structural components are formed with a 3-inch bevel at the corners.

The roadway is made up of two 15-foot travel lanes and is partly cantilevered out beyond the arch on the ends of the transverse beams. The bridge's railing is 3 feet high and consists of 10-foot lengths of square balusters between piers, with larger piers marking the end columns of the main span and the ends of the bridge. The date 1934 is incised on one railing pier at each end of the bridge.

Structurally the approach spans consist of a series of paired columns, between which run transverse beams to support the roadway slab. The approach spans repeat the details of the main span, including the capitals on the columns and the arched fascia beams. The end abutments of the bridge are simple reinforced-concrete retaining walls.

The bridge's historic appearance remains substantially intact. In 1970 a rehabilitation of the bridge replaced cracked and spalled concrete; however, except for faint marks from plywood forms (the original forms were made of boards), it is difficult to distinguish this work from the original. Replaced sections of railing exactly duplicate the original balusters but in a somewhat grayer color than the older portions, which have weathered to a light brown. The only missing element is a raised course on the outside of the bridge that marks the bottom of the railing; much of this protrusion has broken off or been removed, especially along the north side of the bridge.

Historical Background

The Route 80 bridge was one of several large bridge projects undertaken by the Connecticut State Highway Department in the early 20th century as part of its efforts to create a state-wide network of modern roads. The Connecticut Highway Commission was established in 1895 as an agency to advise local highway officials and provide some state funding to aid in the improvement of town roads; two years later, the three-person commission was superseded by a single Highway Commissioner with jurisdiction over the state's road-building efforts. The State Highway Department was the operating agency carrying out the Commissioner's responsibilities.

In 1907, an important step was taken with the designation of fourteen highways as Trunk Lines. In addition to providing for direct state construction and maintenance of major roads, the Trunk Line legislation recognized the desirability of creating a system of interconnected improved roads to serve the entire state. Enacted at a time when the Connecticut General Assembly was disproportionately dominated by rural interests, the Trunk Line system was regarded as vital to increasing the Connecticut farmer's access to markets. In 1915, the legislature added the construction of Trunk Line bridges to the responsibilities of the State Highway Department.

Over the next two decades, the department undertook the construction of hundreds of bridges as it upgraded the Trunk Lines to meet the needs of rapidly rising numbers of automobiles and trucks. All sizes and kinds of bridges were used, and most, like Bridge No. 1132, were designed by departmental engineers. Although trusses and steel-beam

bridges were chosen for some circumstances, reinforced concrete was the material of preference. Like their counterparts in other states, Connecticut's early 20th-century state engineers valued concrete for its strength, low cost, and promise of minimal maintenance. Concrete construction also provided business for local suppliers and contractors.

The bridge was constructed as part of a major rebuilding of Route 80 in Madison and Killingworth. Route 80 was a Trunk Line road extending from New Haven eastward to the Connecticut River; the area was primarily agricultural at the time. Since Route 80 was the first east-west route in central Connecticut inland of Long Island Sound, it undoubtedly was of great use to the residents of this part of the state, allowing not only east-west travel but also providing access to several intersecting north-south Trunk Line roads.

The Route 80 project was carried out under the state's Trunk Line Reconstruction program and was funded by Federal Aid grants. In addition to the Hammonasset River bridge, the work required the construction of numerous concrete beam and slab bridges over smaller streams; these had the same simple square-baluster railing as Bridge No. 1132. Expenditures for the project in fiscal years 1935 and 1936 totaled more than $480,000. The work was carried out by the Osborn-Barnes Construction Company of Danbury, Connecticut. A medium-sized general contractor, Osborn-Barnes advertized road building as one of their chief specialties.

Technological Significance

Because they were employed for relatively long spans, open-spandrel arches represented the height of reinforced-concrete bridge engineering in the early 20th century. Although no different in principle from other types of arches, the open-spandrel design was extremely economical in the amount of material required. By supporting the roadway on columns rather than on fill enclosed by solid spandrels, the design greatly reduced the dead load of the structure and thus allowed a relatively light arch to span the crossing; further savings accrued from the use of ribs rather than a continuous arch barrel. The penalty for such economy was greater complexity of design and an increase in the time and labor needed to build the forms, but particularly for spans in the range of 100 to 200 feet, the open-spandrel design was worth the trouble.

Open-spandrel arches were discussed in detail in several early 20th-century engineering texts,[1] including methods for determining the proper size of the ribs, carrying columns, and cross-beams and the sizing and placement of reinforcing rod. The Connecticut State Highway Department completed its first open-spandrel arch in 1918, a 55-feet-long continuous-barrel design that served as a prototype for five large river crossings built by the department in the 1920s and 1930s, all of them with span lengths of 100 feet or more. In nearly every case, the length of the open-spandrel arch allowed the state highway to cross these river valleys at a much higher level, thus eliminating the need for steep grades on either side. Of nine bridges specifically cited by the department as major works of engineering in its 1935 history, four (including Bridge No. 1132) were open-spandrel designs.[2]

The period's engineers were also enamored of the open-spandrel arch's aesthetic qualities: its light and airy appearance, the slenderness of its members, and the soaring lines of the arch itself. Where there was a lack of bedrock to bear the footings or a low-grade approach, the Connecticut State Highway Department reluctantly traded in the open-spandrel arch's "artistic worth" for a steel truss, which it derided as "utilitarian, having little or no artistic merit."[3] Bridge No. 1132's restrained Classical detailing, such as its balustrade railing, the arched openings, and the detailing of the columns with moldings suggestive of capitals, provide

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[1]Conde B. McCullough's Economics of Highway Bridge Types (1929) is notable both for its thoroughness on the subject of the open-spandrel design and for the author's extensive experience with the type as Bridge Engineer with the Oregon State Highway Commission. Other period texts treating the open-spandrel type are J. A. L. Waddell, Bridge Engineering (New York: John Wiley & Sons, 1916); George A. Hool and W. S. Kinne, Reinforced Concrete and Masonry Structures (New York: McGraw-Hill Book Company, 1924); and Leonard C. Urquhart and Charles-Edward O'Rourke, Design of Concrete Structures (New York: McGraw-Hill Book Company, 1926).

[2]Connecticut State Highway Department, Forty Years of Highway Development in Connecticut, 1895-1935 (Connecticut Tercentenary Commission Publication No. 46; New Haven: Yale University Press, 1935), 10-11.

[3]Ibid., 11.

further evidence of the Connecticut State Highway Department's aesthetic intentions. Clearly, the bridge was meant to be both an exemplar of the department's high level of technical competence and a scenic complement to the waterfall and hemlock-bordered stream in the ravine below.

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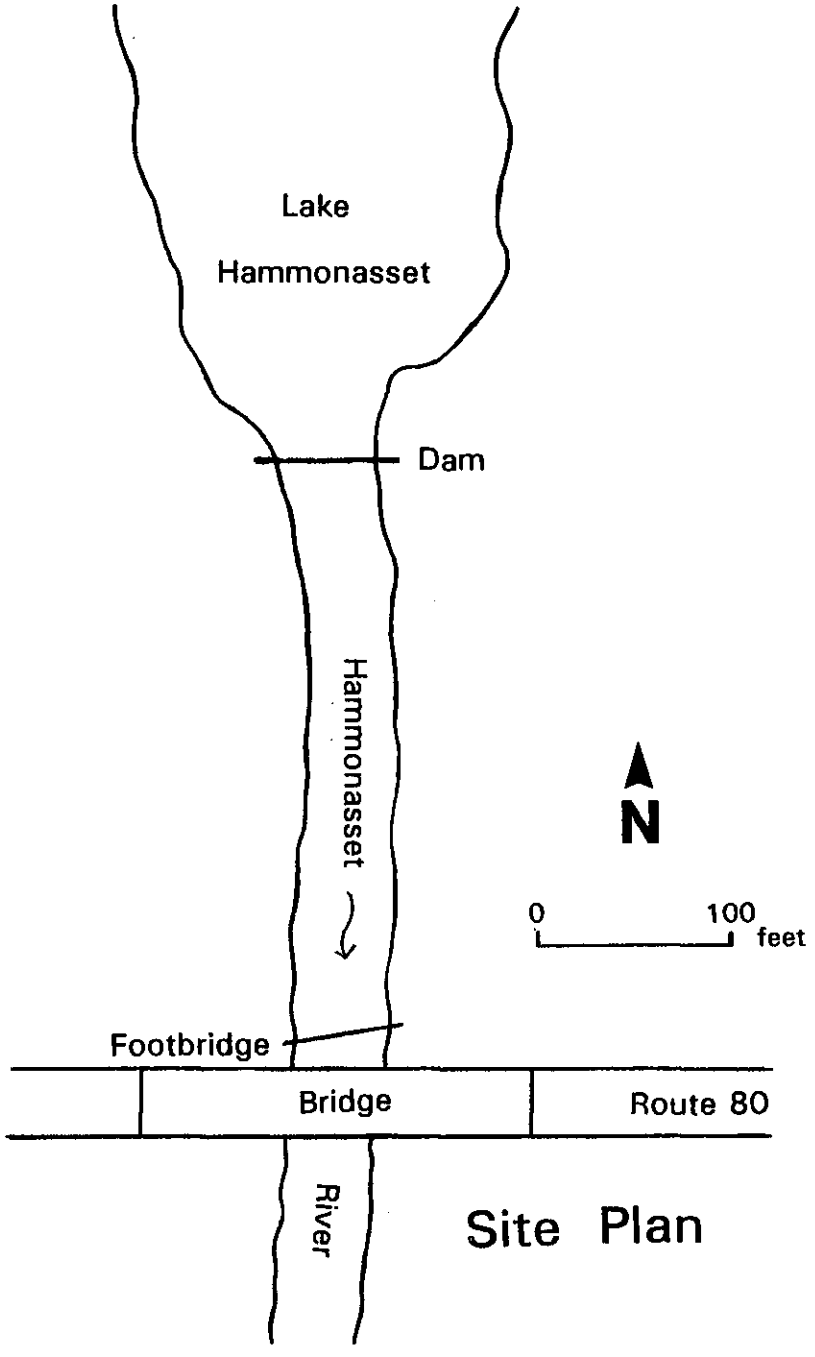
Waddell, J. A. L. Bridge Engineering. New York: John Wiley & Sons, 1916.

Note on historical photographs: the Connecticut State Library has a large collection of construction and record photographs taken in this period by the State Highway Department; however, the collection is currently being processed and is not available for use.


Lake
Hammonasset
Dam
Hammonasset
N
0
100
feet
Footbridge
Bridge
Route 80
River

Site Plan